TMDL Development & Implementation: A Conceptual Framework

Presented at the
TMDL Implementation Workshop for
Local Governments
September 13, 2004

Systematic Clean Water Act Framework

- **Establish Water Quality Standards**
- **Assess Waters of the State**
- **Identify Impaired Waters on 303d List**
- **Conduct TMDL Analysis**
- **Implement TMDL**
- **Evaluate**
  - **Provide Feedback Information**

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+ This slide provides the big picture context for our discussion of TMDL implementation. It outlines a systematic framework, which includes formal public scrutiny each step of the way.

+ Water Quality Standards are the Foundation for all the steps that follow.

+ This includes assessing the waters of the State.

+ The next step, conducted every two years, is to evaluate all available data to identify and document impaired waters on the State's303d List, including the substance or stressor causing the impairment.

+ The 303d list guides the next step, which is conducting separate TMDL analyses for each listed substance causing an impairment to each given waterbody. The result of the analysis is a quantified estimate of the maximum allowance of the impairing substance, or stressor, that will meet water quality standards. This is the TMDL, or Total Maximum Daily Load.

+ The TMDL analysis, in turn, guides the implementation needed to meet water quality standards. We will talk more about what it means to implement a TMDL later.

+ And finally, by design, the Clean Water Act framework envisions that the information gained during the TMDL Development and Implementation processes will be used provide feedback information to guide refinements of the water quality standards, and the other aspects of the framework.

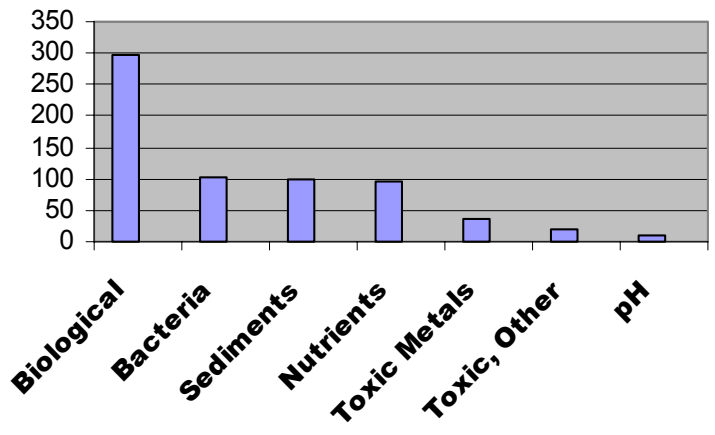
+ It will be helpful to keep this this systematic framework and feedback mechanism in mind as we discuss TMDL implementation.

TRANSITION:

+ I was asked by the Workshop planning committee to provide a general TMDL case study. The purpose is to give workshop participants a mental picture to draw upon while thinking about TMDL implementation issues.

+ But, before I focus on one example, I'll briefly note the following.

Wide Variety of Impairments



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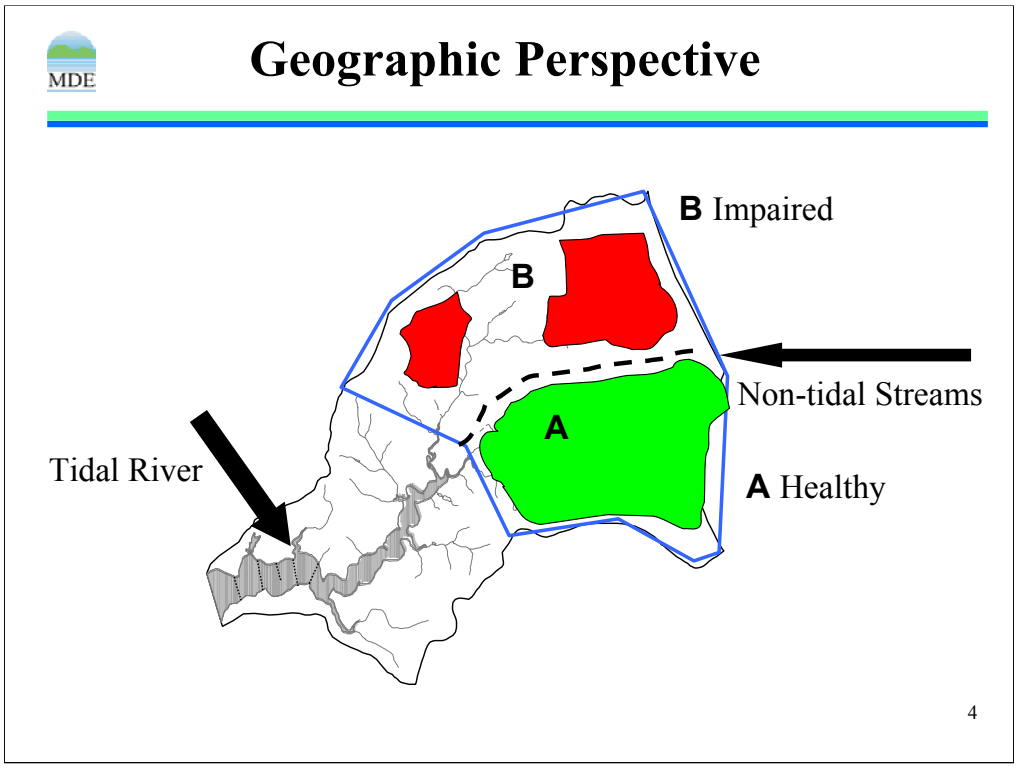
+ We are dealing with a wide variety of pollutants as summarized on this graph. We must address a lot of different types of waterbodies, tidal rivers & estuaries, non-tidal streams, and reservoirs. Furthermore, impairments can be expressed in the water itself, the physical habitat, the bottom sediments, or as bioaccumulated toxins in fish tissues.

In short, there are a wide variety of situations, most of which are beyond the scope of today's workshop.

TRANSITION:

+ Thus, by necessity, the case study I will present is a significant simplification.



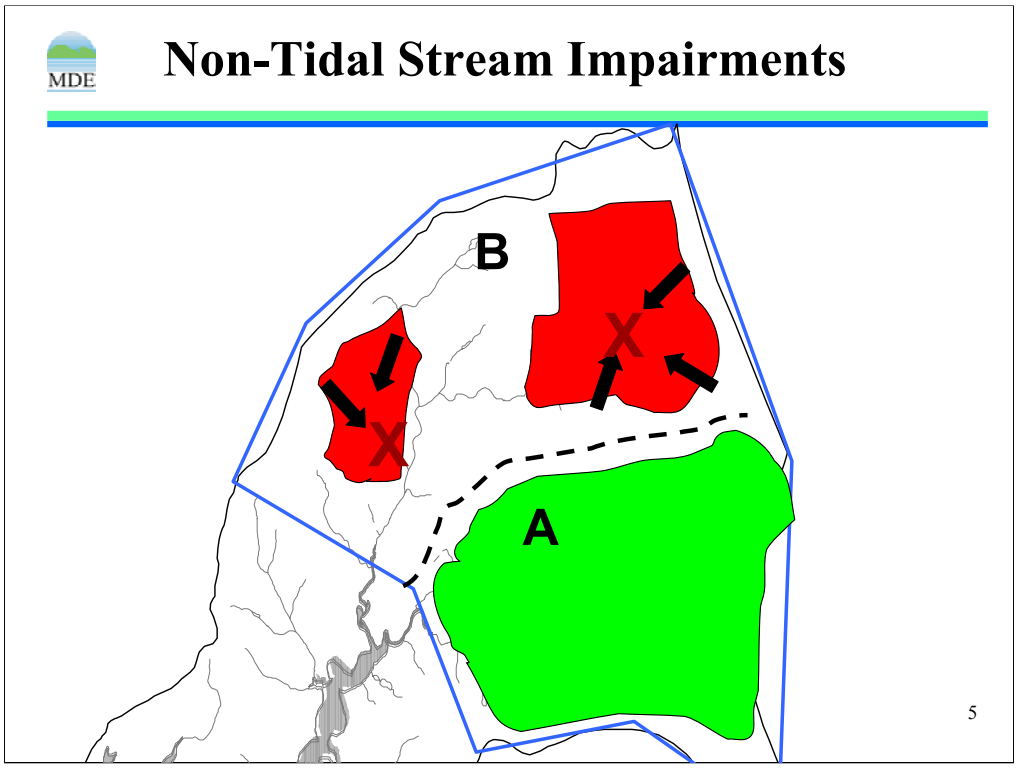
Lets begin by considering the geographic perspective of a watershed that includes a tidal river and non-tidal streams that drain to the tidal river. Maryland can be divided into about 130 watersheds according to an 8-digit coding system. This is the typical scale at which we address nutrient TMDLs for tidal waterbodies.

Notice that the watershed draining to the tidal river is composed of two separate subwatersheds identified by the letters A & B. You now see a natural partitioning of three separate waterbodies; the tidal river, and two non-tidal streams draining to the tidal river.

It is possible for each of these waterbodies to have a different water quality status. For example, subwatershed **A** could be highly forested, and the non-tidal stream could be healthy. At the same time, subwatershed **B** might have impairments expressed by a low index of biological integrity. The tidal river might or might not be impaired.

TRANSITION:

Lets briefly take a closer look at the non-tidal stream in sub-watershed B before turning our attention to the tidal river downstream.



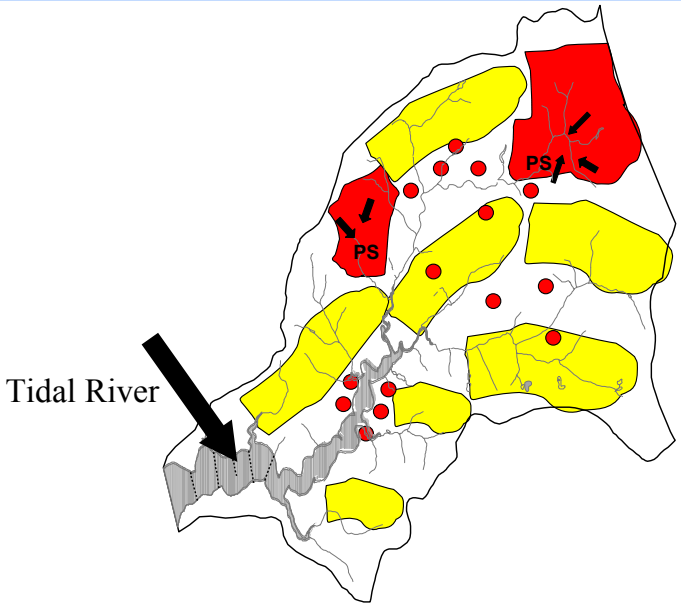
+ In subwatershed B, the land cover has been modified. Removal of forested land cover changes the watershed hydrology, resulting in more surface runoff during storm events. The storm water rushes off the lands surface with increased energy eroding both the surrounding landscape and the stream channel itself. This can cause an impairment of the non-tidal stream.

+ Even though this this impairment might result in sediments and nutrients being transported far downstream to the tidal river, it is separate and distinct from a possible impairment of the tidal river. Consequently, impairment of the non-tidal stream warrants its own TMDL analysis, independent of the water quality status of the tidal river downstream.

TRANSITION

+ Now lets turn our attention downstream to the tidal river.

Tidal River Nutrient Impairment



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+ The tidal river is the repository for everything that drains from far upstream in the entire watershed. If excessive amounts of nutrients drain downstream to the tidal river, they will cause excessive growth of algae, which can cause low levels of dissolved oxygen, reduce the water clarity which impairs the growth of submerged aquatic vegetation, which serves as habitat for crabs and fish. All of this can result in a general imbalance in the ecosystem reflected in the loss of sensitive species, and a reduction in biological abundance and diversity. This is the situation that motivates a lot of attention within the Chesapeake Bay Agreement, and in particular the Tributary Strategies for nutrients.

+ The many different sources of nutrients are typically distributed widely throughout the watershed. In addition to natural sources of nutrients, they include various agricultural sources, septic systems, urbanized areas with impervious surfaces from which atmospheric deposition of nutrients is efficiently washed off during rain storm events, point source discharges (both municipal treatment plants and some types of industrial discharges), and contributions from erosion of the landscape and the stream channels as we discussed previously.

+ Again, because the tidal river impairment is distinct from the non-tidal streams, the downstream nutrient impairment warrants a separate TMDL analysis.

TRANSITION:

Using this tidal nutrient example, lets look briefly at the more traditional TMDL Development process, and then turn to TMDL Implementation in that context.

The Essence of TMDL Development

Two quantified elements must be linked by a predictive tool.

(Pollutant) ⇨ (WQ Model) ⇨ (Water Quality)

(Watershed Model)

(TMDL) ⇨ (WQ Model) ⇨ (WQ Standard)

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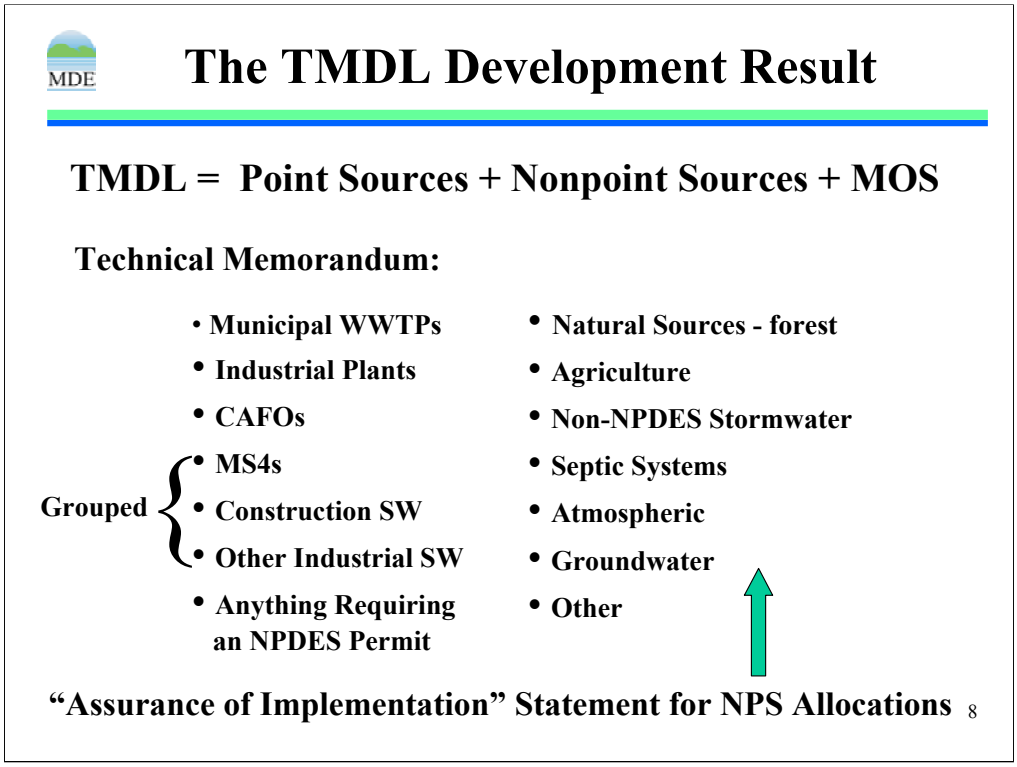
+ The TMDL analysis links two quantified elements: The pollutant and the water quality.

+ These two quantified elements must be linked by a predictive tool. That is, we need a tool for predicting how the water quality would change if different amounts of pollutants were added to it. The linkage of the pollutants to the water quality response is typically done using a water quality model.

+ In a nut shell, during a TMDL analysis we simulate different levels of pollution going into the water, and see what the water quality model predicts will happen. We adjust the simulated pollutant loads until we determine the amount that just meets the water quality standard. That amount is the TMDL.

TRANSITION:

+ Lets look at the results of a TMDL analysis with implementation in mind.



+ In addition to the TMDL number itself, the analysis must also include an allocation of the total load among point sources, and nonpoint sources, typically with some unused portion set aside as a margin of safety.

+ One could say that both the TMDL and the allocations are initial steps in an implementation plan. That is, we know the waterbody is impaired by too much pollution. The TMDL tells us how much is too much, thereby giving us a quantified target for our implementation. The allocations among point and nonpoint sources refine this quantified implementation target into broad source categories.

+ With each TMDL document submitted to EPA, we provide a Technical Memorandum which is supporting information, not a formal part of the TMDL. The Technical Memo describes a viable partitioning of the loads among more detailed source categories. In this regard, the Technical Memo can be viewed as another initial implementation planning element of the TMDL development process.

+ For point source allocations, the Technical Memo typically identifies anything requiring an NPDES permit. We group source categories together for which we do not have sufficient information to justify individual allocations, as you see with the grouping of stormwater allocations. We do, however, make separate stormwater allocations to individual jurisdictions. Keep in mind that stormwater allocations are a new requirement, which have only been explicitly incorporated in a few of the approximately 100 TMDLs developed thus far. They are implicitly included in the earlier TMDLs.

+ For nonpoint sources, we have made less use the Tech Memo for TMDL implementation planning. Although we typically provide a partitioning of the load to land use categories or subwatershed, per EPA's request, they should not be interpreted as allocations; That is intentionally left to be addressed during the TMDL implementation process.

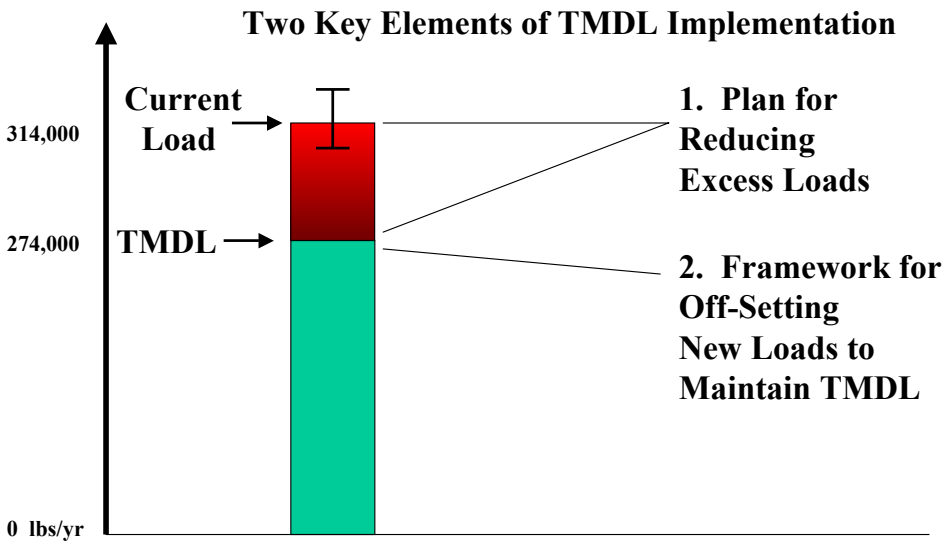
+ Another aspect of our TMDL documents, which constitutes a step toward TMDL implementation planning, is what's called an "Assurance of Implementation" chapter. This required element of an approvable TMDL is motivated by the need to convey that the allocation given to the nonpoint source category is reasonable relative to the allocation given to the point source category. That is, you can't give everything to the regulated point sources, and leave nothing for the unregulated nonpoint sources.

+ It should be apparent that the TMDL is somewhat flexible, and does not prescribe HOW the allocations are to be achieved. Furthermore, after the TMDL is approved by EPA, it is possible to redistribute allocations among the sources, provided that the reallocations are done in a transparent way with public review. The subject of managing allocations is a non-trivial matter that I'll touch upon again later.

TRANSISION:

+ You can see that the TMDL result itself, though primarily a statement of the capacity for a given water body to assimilate a given pollutant, also contains elements that constitute initial steps toward implementation planning. Lets now move past the TMDL development step, to TMDL implementation.

Elements of TMDL Implementation



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+ This slide depicts a hypothetical existing pollutant load as a stacked bar graph, with the pounds per year on the left axis.
+ The top of the bar represents the estimated current load, for which there is typically uncertainty, represented by the error bar.
+ The TMDL is represented by the top of the lower bar.
+ There are two key elements of TMDL implementation that are relevant to local governments.
  - First, a plan for reducing the current excessive pollutant loads.
  - Second, a management framework for off-setting new pollutant loads in the future.

TRANSITION:

+ As you listen to presentations throughout the remainder of the day, and you pose questions or suggestions, try to keep the distinction between these two key elements in mind. If relevant, note to which of these two key elements your question or comment applies.
+ Given the limited time, I will close by briefly exploring these two key elements of TMDL implementation.

Plans to Reduce Excess Loads

- Many of the Current Activities = TMDL Implementation
- Track Your Pollutant Reduction Activities
- Documentation: State Water Quality Management Plans
  - Comprehensive Conservation & Management Plan (CCMP)
  - Reservoir Management Plans
  - Tributary Strategies
  - Watershed Restoration Action Strategies
- Technical Assistance: MDE Initiative
- Guidance: To be developed with Local Governments
- Reduction Plans are Related to Off-sets for Future Loads

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+ Lets look at the matter of reducing current excess loads.

+ Many of the current environmental activities conducted by local governments are already helping to reduce excess loads. These activities can be credited toward TMDL Implementation, even in situations where TMDLs have yet to been developed. So, for example, if you are working with the Army Corps of Engineers on a project, you might consider requesting that their documentation makes reference to TMDL implementation. In short, you can begin to incorporate language about TMDL implementation into documentation of many local projects. Even if you do not include any numerical load reduction estimates, you can quantify things, such as miles of stream restoration, or acres of wetlands restoration. Obviously, being able to do this implies that you know which waters require what types of TMDLs. We can work with you on gaining that kind of information.

+ Implicit in what I've just said is that we all need to track our pollution reduction activities, even if we cannot put a load reduction number to them. We know some of you track activities as a requirement of your NPDES Stormwater permit and through other programs. You should also consider keeping a rudimentary paper file in which you drop occasional notes on things for which you should receive TMDL implementation credit; for example, a simple note referencing the Army Corps project. Such a file could be useful if ever you need to demonstrate that your jurisdiction is making a good faith effort towards TMDL implementation. You might ask yourselves who within your jurisdiction should do this? The TMDL Primary Contact might be a good candidate, though he or she is likely to need help, because activities are typically widely disbursed across different local governmental units.

+ What about more formal documentation of pollution reduction planning? According to federal regulations, TMDLs are to be reflected within State Water Quality Management plans. Maryland has a flexible definition of its State Water Quality Management plans. Here are several quick examples:

+ The Comprehensive Conservation & Management Plan provides a logical planning framework for Maryland's Coastal Bays Region.

+ Maryland has a long history of developing Reservoir management plans for our drinking water supplies. These provide a potential framework for pollution reduction planning if we choose to use them in that manner.

+ The Chesapeake Bay Tributary Strategies are considered to be part of the nutrient TMDL implementation planning framework for Maryland. Any action taken to meet the Trib Strategies can be credited toward meeting TMDLs, and vice versa. Although the Trib Strategies are presently described at a fairly coarse geographic scale, that scale will be refined as new information and tools are developed over the next couple of years.

+ We are also exploring the use of Watershed Restoration Action Strategies "WRASs" for documenting pollutant reduction plans, which is a good segue to my next point.

+ The Maryland Department of the Environment has adopted a new Departmental Initiative in support of nutrient TMDL Implementation. As currently stated, the initiative assists local governments by incorporating TMDL implementation concepts into local planning efforts. Our commitment for Fiscal Year 2005 is to do this for 20% of existing nutrient TMDLs. The specifics of this initiative are flexible. However, the intent is to begin taking tangible planning steps toward TMDL implementation. Our first example of this was to work with Worcester County to explore quantitative planning to reduce existing excess loads. This project was a subelement of one of DNR's Watershed Restoration Action Strategies being developed in the Coastal Bays region. The Departments of Agriculture and Planning have also been involved. We will hear from Worcester County on this project later this morning.

+ A key outcome of today's workshop will be a commitment from the Maryland Department of Environment to work with local government representatives on interim TMDL Implementation Guidance specifically geared toward local governments. Among other things, that guidance will address the issue of plans for reducing excessive loads.

+ Finally, it is important to note that load reduction plans have a relationship to the topic of creating management frameworks for off-setting future loads. Simple logic suggests that, to allow for new loads, we should be able to show the public that we have a plan for reducing existing excessive loads.

TRANSITION:

+ With that as a segue, lets briefly consider the topic of planning for future loads.

Framework to Off-Set New Loads

- Paradigm Shift
- Need to Link Water Quality Impacts with
  - Comprehensive Planning & Zoning
  - Water, Sewer and other Infrastructure Planning
  - Subdivision Planning & Design
- Managing Allocations
- Motivates Advances in Information Management
- Context for Innovative Incentive Systems

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+ The Chesapeake Bay Agreement has directed a lot of attention to load reduction planning. Significantly less attention has been given to the issue of maintaining loading limits into the future, which translates to off-setting new loads. Conceiving of and establishing the management framework for doing this will necessitate a paradigm shift for both the State and many local government entities.

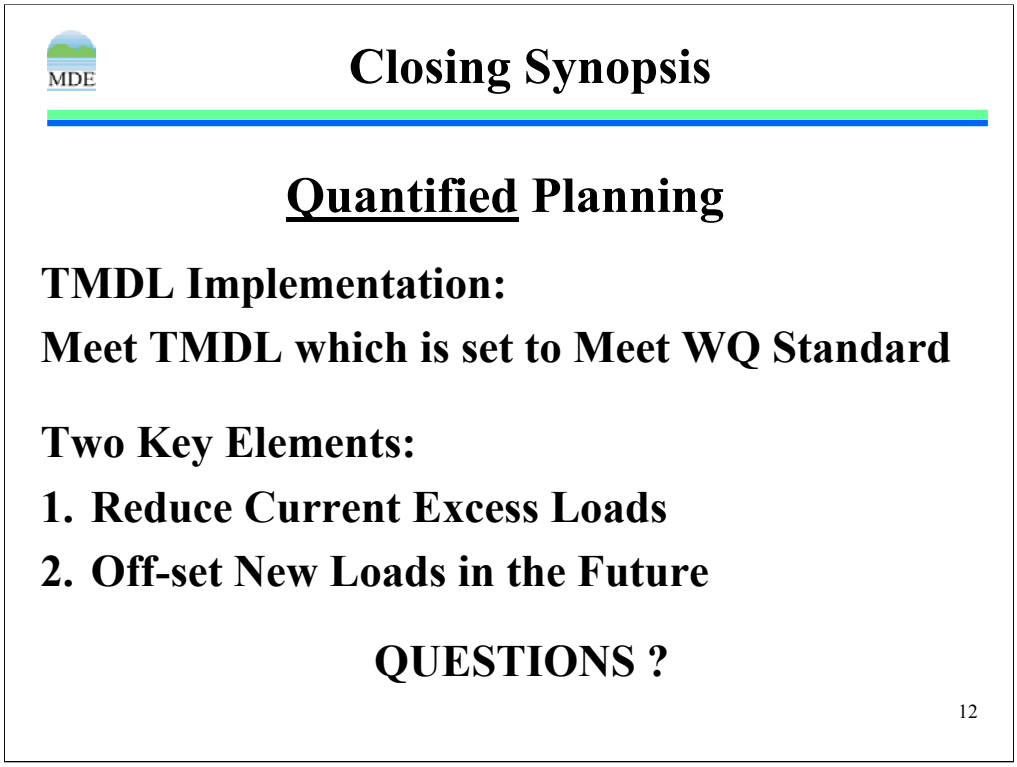
+ For example, there will be a need for making a more explicit link between water quality impacts and planning activities. Some of these planning activities are listed here.

+ The subject of managing allocations, which I touched on earlier, is another new topic we will need to address. For example, a TMDL makes an allocation to urban stormwater, and and another allocation to nonpoint sources from agricultural and forested lands. As the agricultural and forested lands are converted to urban land, a technical and administrative process must occur to reallocate loads from the nonpoint source category to the stormwater point source category. We know that doing this will require a public process, but other details are yet to be worked out.

+ The previous points all suggest that this new paradigm shift in managing future loads will motivate the need for enhanced information management systems to track and account for everything. The task can be accomplished by simple approaches or more sophisticated approaches. The presentations that immediately precede and follow today's lunch will highlight some tools that might begin to give some ideas for approaching this issue.

+ There is a potential over-lap between the two key elements of TMDL implementation. We can find opportunity in the challenge of wanting to do things that generate new loads in the face of having to reduce existing excessive loads. One might envision a local policy that effectively says, "If you want to generate a pound of new loads, you have to help reduce 2-3 pounds of existing loads." This kind of innovative incentive system would leverage the resources of public and private development projects to help reduce existing loads. Creating the administrative framework to efficiently support this kind system is something we all might consider in regard to TMDL implementation.

TRANSITION TO CLOSING SLIDE:



In Closing

+ The essence of TMDL development & TMDL Implementation is Quantified Planning.

+ The essence of TMDL implementation is to take quantified pollution control measures to meet the quantified TMDL, which has been set to achieve quantified water quality standards. The Clean Water Act's focus on quantification is designed to promote accountability.

+ The two key elements of TMDL implementation are 1. To reduce current excess loads, and 2. To off-set new loads in the future.

+ Questions?